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Decoherence window and electron-nuclear cross relaxation in the molecular magnet V 15

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Abstract

Rabi oscillations in the V 15 single molecule magnet embedded in the surfactant (CH 3) 2[CH 3(CH 2) 16CH 2] 2N + have been studied at different microwave powers. An intense damping peak is observed when the Rabi frequency Ω R falls in the vicinity of the Larmor frequency of protons ω N. The experiments are interpreted by a model showing that the damping (or Rabi) time τ R is directly associated with decoherence caused by electron-nuclear cross relaxation in the rotating reference frame. This decoherence induces energy dissipation in the range ω N-σ e<Ω R<ω N, where σ e is the mean superhyperfine field induced by protons at V 15. Weaker decoherence without dissipation takes place outside this window. Specific estimations suggest that this rapid cross relaxation in a resonant microwave field, observed for the first time in V 15, should also take place, e.g., in Fe 8 and Mn 12. © 2012 American Physical Society.

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